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IMPROVED SEALING SURFACE FOR PLASTIC CLOSURE WITH RADIAL SEAL

I. Field of the Invention

This invention relates to threaded closures for steel and plastic drums, particularly drums using elastomeric gaskets positioned around the closure for enhanced sealing. In particular, the closure has a plurality of sealing rings positioned along its sealing surface for proper positioning and improved contact with the sealing gasket.

II. Background Of The Invention

One type of closure and flange sealing mechanism commonly used in steel drum manufacturing involves using an elastomeric gasket positioned radially on a closure. The closure is threaded into a flange, creating a seal gland between them. As the closure is initially threaded into the flange, the elastomeric seal easily starts into the gland. As the closure is threaded further into the flange, the gland becomes tighter causing the gasket to be compressed radially like a cork, creating an effective seal.

Drum manufacturers perform critical testing on the flange/closure seal to ensure that the seal is adequate. The generally accepted manufacturing method of producing plastic closures for use in this particular application requires the use of a split-block mold, which offers the opportunity for "parting line flash," otherwise referred to as parting line mismatch, to be created on the closure's radial sealing surface. The sharp edged surface created by the flash or mismatch is not an ideal sealing surface, and provides a potential leak path through the gland. This is especially applicable when hard elastomeric gaskets are used, for example, low density polyethylene gaskets that may or may not be irradiated, or cork gaskets. The polyethylene gaskets are preferred when sealing aggressive solvents that soft gaskets are typically not chemically compatible with.

In an effort to improve the closure performance, closure manufacturers often perform a secondary operation on the closure when parting line flash or mismatch is present on the sealing surface. Secondary operations include machining the entire outer circumference of the closure sealing gland, or else removing the flash or mismatch through a secondary machining process. In either case, the secondary operations add cost to the product, and lower potential profits to the manufacturer.

This invention creates an improved sealing surface on the closure which drastically improves the performance of a hard elastomeric gasket when used in the above described gland, eliminating the need for a secondary operation to remove parting line flash on the closure sealing surface.

III. Summary Of The Present Invention

The invention consists of a plurality of sealing rings placed on the diameter of a closure used to seal steel or plastic drums that utilize a diametric or cork style sealing gasket. The lower rings (nearest the threads) bite into the gasket as the closure is threaded into the flange, thereby improving the seal. This is due to the radial compression that occurs to the seal as the closure is threaded into the flange. The upper rings cause the gasket to remain vertical so that it enters the gland in the proper orientation. Without the upper ring, the gasket can cock to one side or the other, and potentially be forced out of the gland as the closure is threaded into the flange, rather than becoming compressed within the gland. Also, the upper rings act as additional sealing components, since they too are compressed into the gasket as the closure is tightened into the flange.

The negative effect of typical levels of parting line flash and mismatch, that often occur on the closure sealing surface during generally accepted methods of manufacturing, is greatly reduced when the multiple rings are used. Manufacturing becomes more efficient with the use of this new sealing design since no secondary operation is required to remove the parting line flash and mismatch.

IV. Brief Description Of The Drawings

The present invention will be more fully understood by reference to the following detailed description of a preferred embodiment of the present invention when read in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout the views and in which:

Figure 1 is an exploded perspective view of the closure according to the present invention in combination with the sealing gasket and the container;

Figure 2 is a side elevational view of the closure embodying the present invention;

Figure 3 is cross-sectional view of a portion of the closure showing the gasket in place over the sealing bands with the closure being partially threaded into the container;

Figure 4 is an cross-sectional view of a portion of the closure showing the sealing bands of the instant invention embedded within the gasket as the gasket is compressed between the closure and the container; and

Figure 5 is an enlarged side elevational view of the portion "5" of the closure in Figure 1, showing the sealing bands.

V. Detailed Description of a Preferred Embodiment of the Present Invention

The instant invention is directed towards a threaded closure 10 adapted to close and seal a container 50 such as a steel or plastic drum. This closure 10 provides selective access to materials within the container 50. Referring to Figure 1, the closure 10 embodying the present invention is threadably received within the container 50 opening to seal the container 50 and maintain material within the container 50 during transport and storage. A gasket 60 slips over the threads 38 of closure 10 and nests between the closure 10 and the container 50 to ensure proper sealing.

Referring to Figure 2, the closure 10 comprises a cap portion 20 over an annular side wall portion 30, the annular side wall portion 30 being adapted to matingly fit within the opening of the container 50. The annular side wall portion 30 comprises a top neck

section 32, a threaded section 34 and a bottom neck section 36 beneath the threaded section 34. The base of the bottom neck section 36 may be rounded, tapered or otherwise adapted to be readily inserted within a corresponding opening in the container 50. Above the bottom neck section 36, the threaded section 34 comprises external threads 38 adapted to cooperate with the corresponding threads 52 of the container 50 opening, for secure attachment of the closure 10 to the container 50. Above the threaded section 34, the top neck section 32 includes a plurality of annular sealing bands 40 and 42. In a preferred embodiment of the invention, the annular sealing bands 40 and 42 appear as upwardly and outwardly extending barbs (see Figure 5). Extending outward from the top of the top neck section 32 is the cap portion 20 of the closure 10. This overlapping cap portion 20 forms a shoulder 22 that supports the closure 10 above the opening of the container 50. The cap portion 20 also provides a gripping surface for an operator to remove the closure 10 from the container 50.

Referring to Figure 3, the closure 10 is shown partially threaded into the container 50. The container 50 has an upwardly extending annular flange 52 around the opening for receiving and supporting the closure 10. As shown, the mating threads 54 of the container 50 are situated on the inner surface of the upwardly extending annular flange 52. To provide enhanced sealing between the closure 10 and the container 50, it is conventional to use a sealing gasket 60, situated under the shoulder 22 between the cap portion 20 and the top neck section 32 of the closure 10. The gasket 60 is placed on the closure 10 by moving the gasket 60 over the threads 38. The gasket 60 is then anchored under the shoulder 22 beneath cap portion 20 and over the sealing bands 40 and 42. Now referring to Figure 4, as the closure 10 is threaded within the container 50, the gasket 60 is radially compressed between the closure 10 and the annular flange 52 of the container 50, thereby providing an enhanced sealing mechanism.

Although the conventional method of using a gasket 60 to provide enhanced sealing is widely used within the industry, it has been observed that the sealing qualities of the gasket 60 are greatly reduced by the presence of a parting line flash or a parting line mismatch on the sealing surface of the top neck portion of the closure 10. The parting

line flash is a direct result of the split-block mold used in the manufacture of the closure 10. The parting line flash disrupts the sealing surface of the closure 10 by causing a line of separation between the sealing surface of the top neck section 32 and the gasket 60. This is most often observed when a hard elastomeric gasket or a cork gasket is used. To overcome this flash problem, the industry has typically resorted to performing a secondary operation on the closure to remove the flash from the sealing surface of the top neck section 32 of the closure 10. These secondary operations include machining the entire sealing surface of the closure, or using some polishing mechanism to remove the flash.

Pursuant to the instant invention, and as shown in Figures 2 through 5, the preferred embodiment employs a plurality of annular sealing bands 40 and 42 around the sealing surface of the top neck section 32 of the closure 10. The sealing bands 40 and 42 may have many shapes, for example, the bands 40 and 42 may appear rounded or shaped like triangular teeth. However, in the preferred embodiment the sealing bands are shaped as upward and outwardly extending saw-tooth barbs. As best shown in Figure 5, the top surface 41 of the sealing bands 40 and 42 is slightly displaced downwards from horizontal. A 10° downward angle may be used. By contrast, the upwardly angled surface 43 is preferably displaced approximately 50° degrees from horizontal. This saw-tooth shape facilitates both passing the gasket 60 over the sealing bands 40 and 42 and proper seating of gasket 60 under the cap portion 20. As the gasket 60 is placed over the closure 10, the shape of the bands 40 and 42 allow the gasket 60 to slide upwards over the upwardly angled surface 43 with the minimum of resistance. Further, once the gasket 60 has passed over the sealing bands 40 and 42, the reduced downward slope of top surface 41 resists the downward movement of gasket 60, thereby holding the gasket 60 in its proper position abutting the shoulder 22. Although it is preferably to make the sealing bands 40 and 42 as pointed as possible in order to facilitate penetration into the gasket 60, the actual tips may be rounded due to limitation inherent in the molding process.

As the closure 10 is threaded into the annular flange 52 of the container 50, the gasket 60 is radially compressed between the closure 10 and the container 50. In particular, starting

with the lowermost sealing band, the sealing bands 40 and 42 become embedded within the gasket 60. Furthermore, the upper sealing bands serve additionally to maintain the gasket 60 in the proper vertical orientation with respect to the sealing surface of the top neck section 32, as the gasket 60 is compressed between the container 50 and the closure 10. In effect, the resulting sealing band – gasket 60 interface is sufficient to overcome the negative sealing effects of the parting line flash, thereby creating an improved seal between the closure 10 and the container 50, without the need for additional and costly secondary operations on the closure 10 to remove the parting line flash. Although the invention may be practiced with a single sealing band 40 around the sealing surface of the top neck section 32, the preferred embodiment employs two or more sealing bands 40 and 42. The additional sealing bands provide positional stability to the gasket as the closure is being threaded into the container.

The foregoing detailed description has been given for illustrative purposes only and is not intended to limit the scope of the invention, as some modifications will be obvious to those skilled in the art without departing from the scope and spirit of the invention as recited in the appended claims.

What is claimed is: